Decision Support System Using Fuzzy Multi Attribute Decision Making (FMADM) For The Selection Of Learning Model Alternative

Case Studies : SMA Negeri 5 Semarang

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***Abstract*— The teaching and learning processes related to learning models for delivering learning materials. The achievement of learning goals require some criteria that influence in establishing a learning model. The selection of appropriate learning models, requiring a Decision Support System (DSS) to help provide alternative solutions. One method of DSS is Fuzzy Multi Attribute Decision Making (FMADM). This study discusses the selection of a learning model by finding the best alternative based on criteria that have been determined using the method and do sequence FMADM alternative by using SAW (Simple Additive weighting) to determine the ultimate outcome of sequence alternative weights. The alternative learning model has chosen based on the criteria that have been determined as well as being the best alternative solution..**

Key words : FMADM, SAW, learning model

I. INTRODUCTION

Decision Support System is one part of delivering solution when problem that exist of institution, whether private or public. Increasingly complex problems that arise and occur an institution, such as human resources (HR), services, and other organization or institution that triggers them to deal with the existing problem by building a system. For example, building a system based computerized decision support to improve the quality service teacher of the learning process of student in educational institution.

The learning process is activity, that has its own purpose and involves activities between student and teacher . To achieve the goal of teaching needs to be a proper model of learning for teacher and student . There are several factors to consider in the selection of instructional models , including the factor of learning objectives , the characteristic of the subject matter , student factor , factor of time allocation , and support facilities [7] . The selection of learning models should consider the development of students' abilities are more creative and innovative learning is conditioned on the problem , because the teaching and learning process in the use of learning models have a central function , namely as a tool or a way to achieve a learning goal . Therefore we need a system for the selection of an appropriate learning model for student teachers , so a presentation of student success in learning can be maximized. Of course, taking into account all the factors that influence , including factors both internal and external factors .

FMADM the method of ranking the SAW in a decision support system used to study a model selection problem. For researchers hope to help the role of teacher to students in the learning process by using this method is very interesting and forth with the title "Decision Support Systems using Fuzzy Multi Attribute Decision Making (FMADM) for the selection of learning model alternative".

II. THEORETICAL FRAMEWORK

A. Learning Model

Learning model is a plan or pattern that can be used to shape the curriculum (lesson plans long term), design learning materials and guiding learning in the classroom. Learning model can be used as pattern selection, which means teacher should select appropriate learning model and efficiently to achieve the education goal [6].

B. Decision Support System

Decision support system is a computer-based information systems that provide interactive information support to managers and business practitioners during the decision making process [5].

C. FMADM

Fuzzy Multi Attribute Decision Making (FMADM) is a method used to find an alternative to certain criteria. FMADM is the core of determining the weights for each attribute, followed by a ranking process that will select the alternative that has been given [4].

D. Algorithm FMADM

- Give the value of each alternative (Ai) on each criterion (Cj) are already determined, with the values, obtained by the crisp value I = 1,2…m and j = 1,2…n.
- Gives the weights (W) were also obtained by crisp values.
- Matrix normalized by calculating the value of normalized performance rating (rij) of alternative A_i C_j attributes based on equations that are tailored to the

type of attribute (attribute profit / benefit or cost attribute = Maximum / Minimum cost =). If the value of the benefit in the form of attribute crisp (X_{ij}) of each attribute column divided by the value of crisp MAX (MAX X_{ij}) from each column, while the costs for attributes, crisp value MIN (MIN X_{ij}) of each attribute column divided by the value of crisp (X_{ij}) each column.

- The process of ranking the normalized matrix by multiplying the value of the weight (W).
- Determine the preference value for each alternative (V_i) by summing the product of the normalized matrix (R) with the weights (W). V_i greater value indicates that the alternative Ai, be elected.

E. SAW Method

SAW method is often also known as the weighted sum method term. The basic concept is the SAW method for weighted sum of rating the performance of each alternative on all attributes. SAW method requires the decision matrix normalization process (X) to a scale that can be compared with all the existing alternative rating.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\underset{i}{Max}\ x_{ij}} \\ \dfrac{\underset{i}{Min}\ x_{ij}}{x_{ij}} \end{cases} \quad (1)$$

Where r_{ij} is the normalized performance rating of alternative A_i on attribute C_j with i = 1,2, ... m and j = 1,2, ... n, and the preference value for each alternative (V_i) is given as:

$$V_i = \sum_{j=1}^{n} W_j\, r_{ij} \quad (2)$$

V_i greater value indicates that the alternative (Ai) is selected [4].

III. METHODS AND REALIZATION

A. Designing FMADM

Conducting election learning model by looking at several indicators, including learning objectives, learning materials, the ability of students, availability of facilities, the allocation of time, the ability of the teacher. Furthermore each of these indicators are considered as the criteria that will be used as a determining factor for effective learning model. Her fuzzy set is very less, less, pretty, good and very good. The set is then treated as the input to the system FMADM.

B. Data Alternative Learning Model

There are alternative models of learning are as follows:

- Contextual learning model (Contextual Teaching and Learning)
- Cooperative learning model
- Problem based learning model
- Thematic learning model
- Computer based learning model
- PAKEM (Participatory, Active, Creative, Effective and Fun) model
- Model of web-based learning (E-Learning)
- Self-learning models

C. Determine The Criteria Needed

In this study, there are several criteria and weights are needed to determine appropriate instructional model of learning materials. The criteria are as follows; C1 = learning materials, C2 = learning objectives, C3 = ability students, C4 = The ability of teacher, C5 = availability of facilities, C6 Allocation of time. Weights to each criteria is given as : W = [very less, less,enough, good, very good].
Here is a fuzzy number of weights:
Very less (SK) = 0
Less (K) = 0,25
Enough (C) = 0,5
Good (B) = 0,75
Very Good (SB) = 1
Predefined fuzzy numbers can be seen in Figure 1.

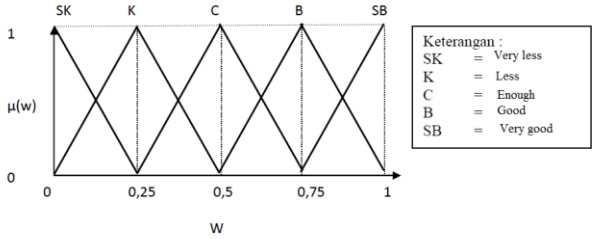

Figure 1. Graphs fuzzy of numbers to weights

- Learning Materials criteria

TABLE 1

Learning Materials	***Descripton***	***Value***
Aspects of the concept	Yes / No	1 or 0
Fact aspect	Yes / No	1 or 0
Principle aspects of	Yes / No	1 or 0
Aspects of the process	Yes / No	1 or 0
Aspects of Value	Yes / No	1 or 0
Aspects of Intellectual skills	Yes / No	1 or 0
Aspects of psychomotor skills	Yes / No	1 or 0

- Learning Objectives criteria

TABLE 2

Learning Objective	***Descripton***	***Value***
Cognitive	Yes / No	1 or 0
Affective	Yes / No	1 or 0
Psychomotor	Yes / No	1 or 0

- Student abilities criteria

TABLE 3

Student abilities	***Fuzzy Set***	***Value***
< 5,00	Very Less	0
5,00 <6,00	Less	0,25
6,00 <7,00	Enough	0,5
7,00<8,00	Good	0,75
>=8,00	Very Good	1

- The ability of teacher criteria

TABLE 4

Ability of Teacher	*Fuzzy Set*	*Value*
0	Very Less	0
1	Less	0,25
2	Enough	0,5
3	Good	0,75
4	Very Good	1

- Availability of facilities criteria

TABLE 5

Availability of facilities	*Fuzzy Set*	*Value*
Do not have	Very Less	0
Had but broken	Less	0,25
Have yet not be able to operate	Enough	0,5
had and maintened	Good	0,75
Owns and can operate	Very Good	1

- Allocation of time criteria

TABLE 6

Allocation of time	*Fuzzy Set*	*Value*
Very Less	Very Less	0
Less	Less	0,25
Enough	Enough	0,5
Good	Good	0,75
Very Good	Very Good	1

D. System Design

- Context Diagram

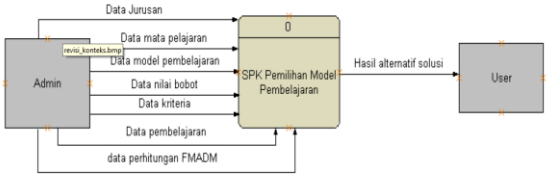

Figure 2. Context Diagram

- Data Flow Diagram (DFD) Level 1

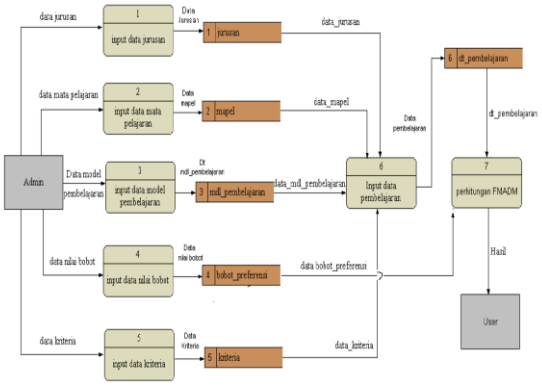

Figure 3. Data Flow Diagram (DFD) Level 1

- Data Flow Diagram (DFD) Level 2

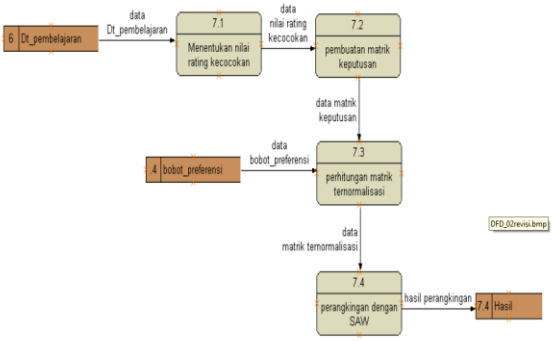

Figure 4. Data Flow Diagram (DFD) Level 2

E. Program Design

- Start Form

Figure 5. Start form

- Input data form

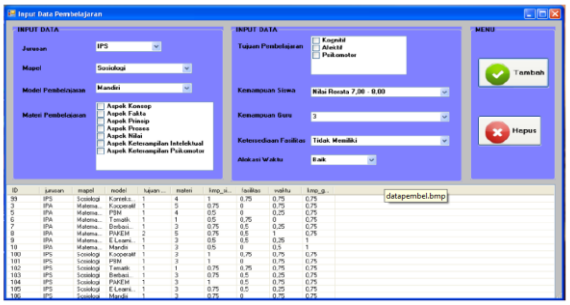

Figure 6. Input data form

- Result form

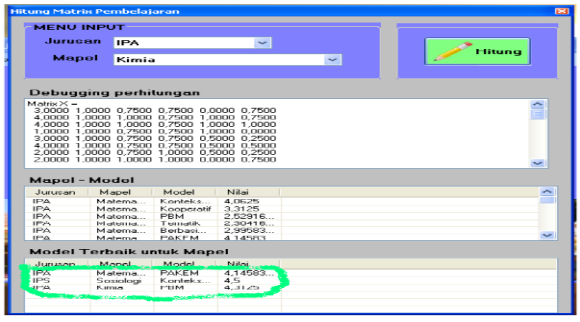

Figure 7. Result form

IV. RESULTS AND DISCUSSION

After entering the data criteria, then the next step is making the decision matrix X with a sample calculation for mathematics subject of theoretical calculation, as follows:

$$X = \begin{pmatrix} 5 & 2 & 0,75 & 0,75 & 0,75 & 0,5 \\ 5 & 1 & 0,75 & 0,75 & 0 & 0,75 \\ 4 & 1 & 0,5 & 0,75 & 0 & 0,25 \\ 1 & 1 & 0,5 & 0,75 & 0,75 & 0 \\ 3 & 1 & 0,75 & 0,75 & 0,5 & 0,25 \\ 5 & 2 & 0,75 & 0,75 & 0,5 & 1 \\ 3 & 1 & 0,5 & 1 & 0,5 & 0,25 \\ 3 & 1 & 0,5 & 1 & 0 & 0,5 \end{pmatrix}$$

Then create normalized matrix R obtained from the normalized matrix X, as follows:

$$R = \begin{pmatrix} 1 & 1 & 1 & 0,75 & 1 & 0,5 \\ 1 & 0,5 & 1 & 0,75 & 0 & 0,75 \\ 0,8 & 0,5 & 0,66 & 0,75 & 0 & 0,25 \\ 0,2 & 0,5 & 0,66 & 0,75 & 1 & 0 \\ 0,6 & 0,5 & 1 & 0,75 & 0,66 & 0,25 \\ 1 & 1 & 1 & 0,75 & 0,66 & 1 \\ 0,6 & 0,5 & 0,66 & 1 & 0,66 & 0,25 \\ 0,6 & 0,5 & 0,66 & 1 & 0 & 0,5 \end{pmatrix}$$

Next will be made multiplication matrix W * R and summing the results of multiplication to obtain the best alternative to doing the ranking with the greatest value.

$V_1 = (1)(1) + (0,75)(1) + (1)(1) + (0,75)(0,75) + (0,5)(1) + (0,5)(0,5) = 4,0625$

$V_2 = (1)(1) + (0,75)(0,5) + (1)(1) + (0,75)(0,75) + (0,5)(0) + (0,5)(0,75) = 3,3125$

$V_3 = (1)(0,8) + (0,75)(0,5) + (1)(0,66) + (0,75)(0,75) + (0,5)(0) + (0,5)(0,25) = 2,5225$

$V_4 = (1)(0,2) + (0,75)(0,5) + (1)(0,66) + (0,75)(0,75) + (0,5)(1) + (0,5)(0) = 2,2975$

$V_5 = (1)(0,6) + (0,75)(0,5) + (1)(1) + (0,75)(0,75) + (0,5)(0,66) + (0,5)(0,25) = 2,1800$

$V_6 = (1)(1) + (0,75)(1) + (1)(1) + (0,75)(0,75) + (0,5)(0,66) + (0,5)(1) = 4,1425$

$V_7 = (1)(0,6) + (0,75)(0,5) + (1)(0,66) + (0,75)(1) + (0,5)(0,66) + (0,5)(0,25) = 2,8400$

$V_8 = (1)(0,6) + (0,75)(0,5) + (1)(0,66) + (0,75)(1) + (0,5)(0) + (0,5)(0,5) = 2,6350$

Rangking the result obtained ; V5 = 2.1800, V4 = 2.2975, V3 = 2.5225, V8 = 2.6350, V7 = 2.8400, V2 = 3.3125, V1 = 4.0625, V6 = 4.1425.
The greatest value is in the alternative thus A6 V6 (active and creative learning models) are selected alternative as the best alternative.

V. CONCLUSION

Of the election results by the method FMADM, the best alternative is the alternative to elect six (A6) is active and creative learning models with a number of value = 4.1425. Level comparison of alternative models of active and creative learning (A6) to alternative (Ai) others, was 82.85%: 56.71%.

This shows that the level of accuracy of selection of alternatives (A6) PAKEM of 82.85%.

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